

### REMARKS

This is in response to the Office Action dated May 7, 2003. With this Amendment, claims 1, 4, 5 and 12 are amended, claims 16-21 are canceled, and claims 22 and 23 are added. Claims 1-15 and 22-23 are now pending in this application.

The claims as currently presented require a modeling machine having two or more dispensers carried by an extrusion head, each dispenser receiving modeling filament from a separate source and each dispenser having a tip. The tips are maintained in the same z-plane, and the distance between the tips is a function of the time required for the road to shrink after deposition. New claim 23 is a method claim based upon apparatus claim 1. As described below, the claims as now presented are not anticipated or obvious over the prior art.

### Information Disclosure Statement

In the present Office Action, the Examiner states that references listed in the Specification will not be considered unless properly submitted in an Information Disclosure Statement. Applicant acknowledges this requirement and has previously submitted an Information Disclosure Statement in this case.

### Specification

In the Specification, the Examiner objected to two informalities. The text of the Specification at page 2, lines 7-13 and on page 3, lines 7-14 is amended as requested by the Examiner.

### 37 C.F.R. 1.75(c)

Claims 2 and 13 were objected to under 37 C.F.R. 1.75(c), as being of improper dependent form for failing to further limit the subject matter of the previous claim. Claims 1 and 12 on which claims 2 and 13 depend have been amended such that claims 2 and 13 are now in proper dependent form. Specifically, claims 1 and 12 now claim the modeling material as an element of the apparatus. Therefore, claims 2 and 13, which claim the thermal diffusivity of the roads of modeling material and a transit time, do limit the apparatus as now claimed. Applicant respectfully requests that the objection under 37 C.F.R. 1.75(c) be removed, as the subject matter of claims 2 and 13 now reflect proper dependent form by further limiting the modeling machine of claims 1 and 12.

35 U.S.C. § 102(b) – Crump 5,340,433

Claims 1-5, 12-14, 16-17 and 20-21 were rejected under 35 U.S.C. § 102(b) as being anticipated by Crump (U.S. Patent No. 5,340,433). Claims 16, 17, 20 and 21 have now been canceled. Applicant respectfully asserts that Crump '433 fails to teach each and every limitation of the pending claims, and therefore does not anticipate.

Crump is directed to a modeling machine of the type improved upon in the present invention. The Crump patent, including the particular examples in Figures 6 and 11 noted by the Examiner, does not disclose the modeling machine of the present invention, including a separate tip for each dispenser. Each of the supply chambers shown in Crump '433 terminate in a single tip. The supply chambers shown in Figure 6 of Crump share a single discharge outlet. Consequently, Figure 6 does not disclose multiple separate tips as claimed. The structure of Figure 11 of Crump is described as "the bottom of the dispensing head would terminate at the section line 11--11 (in FIG. 6) along which FIG. 11 is viewed. Thus material would be dispensed through separate orifices 127 at the outlet of each check valve 154." This embodiment of Crump '433 discloses truncation of the lower portion of the dispensing head at the cross-sectional line in FIG. 6 resulting in a nozzle having a single, planar, broad face with a plurality of openings. While multiple supply passages are disclosed, multiple tips consistent with the present invention are not. The claimed dispenser tips are elongated extensions of the extrusion head, each having a downward face. In the apparatus of the present invention, each supply chamber/dispenser terminates in its own, separate tip having its own, separate face.

As the Crump patent does not teach an extrusion apparatus having multiple separate dispensing tips, it likewise does not teach any requirements for spacing multiple tips in accordance with the present invention and as claimed in the subject matter of independent claims 1, 12 and 23.

Likewise, Crump does not teach the claimed tip spacing requirements. Because the dispensers of Crump do not have separate tips with spaced-apart faces as claimed in the present invention, Crump cannot disclose a spacing between the tips. Each of the pending claims as now presented claim the modeling material as an element of the apparatus. Accordingly, the selection of the modeling material as well as the system parameters (i.e. velocity and acceleration of the extrusion head) do structurally define the apparatus and are limitations that must be considered as

defining over the prior art. Therefore, those properties create an apparatus limitation of distance  $s$  for the apparatus claimed, which is not addressed by the Crump '433 patent. The Crump '433 patent fails to teach all of the limitations of independent claims 1, 12, and 23 and therefore cannot anticipate those claims under 35 U.S.C. § 102(b). The remaining claims are also not anticipated as they each depend upon independent claims 1 or 12.

35 U.S.C. § 102(b) -- Tseng 6,030,199

Claims 1-5 (and canceled claims 16-17) were rejected under 35 U.S.C. § 102(b) as being anticipated by Tseng (6,030,199). Tseng discloses an apparatus that includes multiple dispensers for dispensing molten modeling material through adjustable-width planar slots (68) framed by rollers (34). The material is deposited as a planar sheet (44) that is pressed, cooled and leveled by the by rollers (*see* Tseng at col. 5, lines 27-28 and col. 9, lines 47-65). As shown in Fig. 1, the Tseng rollers are disposed beneath the operating dispenser, and act upon the material as it is dispensed. By the time a trailing dispenser can pass over the dispensed material, the material has been cooled and leveled by the rollers to a z-height that will not reach the trailing dispenser tip.

The apparatus disclosed in Tseng does not meet the limitations of independent claims 1 and 12 as amended, or new claim 23, as it includes planarizing rollers which extend beneath the active dispenser. The planarizing rollers in Tseng avoid any possibility of interference between the deposited material and the trailing dispenser tip, as they are disposed beneath the tip of the operating dispenser so as to level the dispensed material to a z-height lower than that of the tips. The apparatus of the present invention does not include rollers or any other planarizer intended to disturb a deposited road, but rather solves the problem of unintended smearing by placing dispensing tips a distance apart that will allow shrinkage due to cooling. The claims as now presented emphasize the deposited roads shrink exclusively due to cooling, to differentiate over this art which uses a planarizing device.

By its use of planarizing rollers, Tseng teaches away from the present invention and is incapable of being operated in a method whereby a road deposited by one of the tips will shrink due only to cooling during a minimum transit time such the other one of the tips does not smear the road.

Consequently Tseng does not anticipate independent claims 1, 12 and 23 of the present

invention under 35 U.S.C. § 102(b) and does not anticipate the claims that are dependent thereon.

35 U.S.C. § 102(e)

Claims 1-4 and 16-17 were rejected under 35 U.S.C. § 102(e) as being anticipated by Yang et al. (6,280,784 B1).

The Yang '784 patent was filed February 10, 2000. On page three of the Office Action, the Examiner recited the pre-AIPA language for 35 U.S.C. § 102(e) and stated that the amendments made to 35 U.S.C. § 102(e) by the AIPA of 1999 and the Intellectual Property and High Technology Technical Amendments Act of 2002 do not apply when the reference is a U.S. Patent resulting directly or indirectly from an International Application filed before November 29, 2000. The Examiner then made the rejection over Yang under § 102(e).

On its face, the Yang '784 patent indicates that it did not result from an application based on a foreign filing and it was not published prior to its issuance. For references under 102(e) that do not result from nor claim the benefit of international application, the 102(e) date is the reference's earliest effective U.S. filing date including any proper benefit claims under 35 U.S.C. § 119(e) or 120. M.P.E.P. 8<sup>th</sup> Edition Revision 1, February 2003 page 700-27. Therefore, the law that must be applied in considering the Yang patent is 35 U.S.C. § 102(e), as amended by the Intellectual Property and High Technology Technical Amendments of 2002. The Examiner's rejection will thus be considered as if made under § 102(e) as amended. The Examiner's rejection will thus be considered as if made under § 102(e) as amended.

Yang discloses an extrusion head carrying two dispensers which share a common supply, as shown in Figure 4. Each dispenser has a separate tip having a downward face, positioned in a common z-plane. But, the Yang apparatus does not teach the distance/spacing required in the claims of the present invention. While the system of Yang is capable of movement in the x, y plane and in the z direction, there is no teaching in Yang regarding velocity acceleration, shrinkage of material or other parameters that need to be considered in the tip structure of the modeling head for the proximal placement of tips. Yang does not identify smearing of deposited material as a concern, and does not disclose whether a second tip ever passes over deposited material in the apparatus taught therein. As Yang '784 does not teach the claimed spacing requirements between the tips,

Yang does not anticipate independent claims 1, 12 and 23. Yang therefore does not meet the limitations of the remaining claims which dependent from these claims.

Further, the Yang dispensing apparatus does not utilize a common nozzle for the two dispensers, as is claimed in dependent claims 4, 5 and 22. Rather, the dispensers are coupled to a common supply but have separate nozzles 188A and 188B from which the separate tips extend.

35 U.S.C. § 103(a) in view of Crump '433

To establish a prima facie case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations.

Claims 6, 8-10 and 18 were rejected under 35 U.S.C. § 103(a) in view of the Crump '433 patent. The arguments presented above regarding the rejection of various claims under § 102(b) by Crump '433 apply to the claim rejections under § 103(a). Crump does not suggest or otherwise teach the separate tips or distance requirements as required in the claims of the present Application. The claimed relationships of the minimum transit time and spacing are not taught and are not obvious in view of Crump.

The present invention recognizes and addresses a problem that Crump and the other references cited herein failed to recognize. In extrusion heads carrying multiple dispensers that include multiple tips and/or multiple orifices, it is desirable to have those openings as close together as possible to enable accurate manipulation and movement of the extrusion head, especially around corners and other fine features. But, if the tips are placed too close together, a road deposited by the leading tip will be smeared or otherwise disrupted by the trailing tip. And, as described in the background section of the present application, a broad-faced nozzle tip having multiple orifices as is disclosed in Crump results in distortions of fine features on the models to be created.

The present invention therefore solves problems in the art by identifying a multi-tip extrusion head wherein a road deposited by a leading tip is not disrupted by a trailing tip. This distance is dependent on the velocity at which the road is deposited, as well as the material that is being deposited. The structural relationship of the distance between two or more tips, that is,

distance  $s$ , in terms of the velocity acceleration, lag time, and consequently thermal diffusivity of the material, are of interest in the present invention. The present invention recognizes that there is a minimum distance between the tips that is dependent on the time for cooling of the deposited material and the rate which the extrusion head is moving. An extrusion head having multiple tips spaced at least this minimum distance can prevent the disruption of a newly deposited road by a trailing tip while minimizing the penalties from spacing the tips a distance apart. Crump neither recognizes nor presents solutions to the conflicting requirements that must be balanced to develop the successful multiple tip extrusion head of the present invention.

In addition, as the Examiner indicated, Crump fails to teach or render obvious the positioning of thermal insulators in the body to thermally isolate two or more dispensers from each other, as required by claims 6-10. Figure 13, no. 240 of Crump is an insulating sleeve provided around the heating coil 238 of a single dispenser. The use of an insulating sleeve to separate one dispenser from another is not taught, suggested, nor made obvious to one of skill in the art by Crump's teaching. Crump '433 does not suggest or otherwise teach to one skilled in the art that it may be advantageous to thermally separate dispensers from each other for the purpose of selectively using the nozzles for dispensing supplies of different materials especially where those materials have different heat properties as is contemplated in the present invention.

35 U.S.C. § 103(a) -- Crump '433 in view of Taylor '967

Claim 7 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Crump '433 in view of Taylor (3,93,967). The first and second embodiments of Crump in combination with Taylor do not teach the use of ambient air as a thermal insulator between dispensers of an extrusion apparatus, as is claimed in claim 7. Neither Taylor nor Crump suggest the placement of a cavity or other passage adjacent to or within a body of an extrusion apparatus for the purpose of separating two or more dispensers to insulate the dispensers from each other by ambient air. As discussed above, Figure 13 of Crump does not teach a thermal insulator between dispensers. As Taylor is directed to the art of injection molding rather than the art of free form modeling of the present invention, Taylor likewise fails to disclose an insulator between dispensers. There is no suggestion for one of skill in the art to combine Taylor with Crump. Even if combined, the details

of claim 7 are neither taught nor suggested by any combination of Crump or Crump in view of Taylor. Consequently, claim 7 is non-obvious over Crump in view of Taylor.

35 U.S.C. § 103(a) – Crump '433 in view of Heller '673

Dependent claims 11, 15 and 19 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Crump (5,340,433) in view of Heller et al. (5,358,673). The combination of Crump with Heller does not suggest the claimed tip spacing distance  $s$  of greater than 0.02 inches, nor does this combination teach the limitations set forth in the independent claims. The failings of Crump regarding the teaching of the apparatus detailed above under both § 102(b) and § 103(a) are incorporated here.

The dispensing apparatus disclosed in Heller is a recoating device for use in building three-dimensional models by a stereolithographic method. (*See, e.g.*, Heller at col. 2, lines 33-43 and Figure 14). The Heller dispensing apparatus dispenses a thin layer of the liquid medium, across the entire width of a container for holding the liquid medium. The result of the dispensing is a unitary liquid layer having a controlled thickness. (Heller at col. 15, lines 11-26). A. preselected cross-section of this layer is then exposed to prescribed energy (i.e. a laser beam) so as to solidify the liquid in the preselected area.

Because the Heller dispensing apparatus dispenses material in uniform layers and not in roads according to a predetermined pattern, Heller is not concerned with the smearing of object features. The spacing of apertures taught by Heller is for the purposes of dispensing the liquid medium in a uniform, thin layer across the container surface. Heller does not address the problem nor the solution identified in the present invention. The aperture spacing taught in Heller is unrelated to the problem identified and solved by the present invention - preservation of object features formed by deposited roads of material. Therefore, it would not have been obvious to one of ordinary skill in the art to combine the teaching of distances in Heller with the disclosure in Crump for separating independent dispenser tips by said distance.

Conclusion

None of the references cited by the Examiner teach all of the limitations of the independent claims, namely 1, 12 and 23 of the present invention. These claims are likewise not rendered obvious by any combination of the references cited herein by the Examiner. In addition,

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the dependent claims further define the invention to promote a multi-tip nozzle for an extrusion apparatus. The Examiner is respectfully requested to reconsider his rejections in light of the newly amended claims that delineate the present invention over the cited art.

Respectfully submitted,

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